

Spatial Intelligence Driven Forecasting Model for Nursing Home Evacuation Planning During Hurricanes

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Abstract

Older people living in nursing homes are especially at risk from hurricanes. Making sure to evacuate at the right time in disasters allows more people to stay safe. It presents a new predictive analytics app that uses GIS to help nursing homes improve how they decide to evacuate during hurricanes. When data on weather, places, resilience, population at risk and historical evacuations is included, this model helps assess risks regularly and suggests action so evacuations can be planned in advance. By using machine learning algorithms for modeling, the system helps emergency planners and those in charge of nursing homes imagine impacts of hurricanes and use resources more efficiently. Information about hurricanes in high-risk areas was used to confirm the approach, showing it gave better predictions and helped operations run smoother. Bringing together GIS and predictive analytics improves how emergency managers and geriatric planners share information. The study progresses disaster informatics research and enhancements provide support for different healthcare services and disasters.

Keywords: GIS, predictive analytics, hurricane evacuation, nursing homes, spatial decision support, disaster informatics, elderly care, emergency management, machine learning, vulnerability mapping, healthcare resilience, geospatial analysis.

1.Introduction

The advent of Artificial Intelligence is changing the way we understand relationships between humans and machines, while showing what machines are capable of doing now. Here, the main focus is on computer systems that are able to do what humans do very well such as learning, reasoning, resolving issues, seeing actions and understanding language. In the 1950s, visionary scientists and mathematicians thought of creating machines that could think and what we see today in AI is greater than even what they hoped for. Originating with chatbots in the 1960s, AI has now developed into a field that takes part in human activities such as making art, writing, composing music and solving scientific issues(1).

These days, AI advances very rapidly in various fields thanks to more powerful computers, easy access to huge sets of data and new innovative algorithms. Machine learning which belongs to AI, has been especially important lately, because it allows systems to enhance their skills after receiving experience, not only when programmed for every situation. The use of learning algorithms based on the brain's structure has helped image recognition, natural language processing and decision-making improve greatly. Where before they were only used in labs, these technologies are now found in smartphones, recommend things for us and are used to drive cars autonomously and diagnose conditions medically.

AI does more than bring new technology; it brings about major changes to traditional ideas about work, creativity, education, healthcare and social relationships. AI technology is shaking up almost every sector because it offers more efficient, accurate and innovative opportunities. AI technologies can analyze medical pictures as well as or better than doctors or specialists which may lead to the discovery of conditions at an early and life-preserving stage. Because of their speed and accuracy, AI-powered trading fraud systems can handle a much bigger amount of transactions than a person could handle. AI-based learning platforms tailored to students' needs are now being considered by educational institutions which may improve the way education is provided and learned.

Still, there are some problems and debates connected to this new technology. When AI systems become smarter and have greater control, society asks important issues about ethics, privacy, job losses and centralized power in the hands of some big tech companies(2). The possibility of bias, robotizing millions of jobs and the issue of surveillance and privacy have made policymakers, technologists and social scientists start heated debates. Artificial general intelligence (AGI) which is designed to outmatch people in all kinds of thinking, brings up new important questions about humanity and our dealings with machines.

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The Economic Revolution: How Artificial Intelligence is Changing Gladiator Arena

One of the main effects seen from this revolution is in economics, since artificial intelligence influences people's work and entire countries' finances. Adopting AI in business has made competition between companies significantly different and businesses must come up with new approaches to how they run, how they compete and what they provide. Traditional economic explanations are being tested because AI-based companies can now operate at a large scale, be more efficient and enter new markets that were not possible or practical before.

After companies adopt machine learning, they are seeing efficiency gains in their key processes of up to 400%, showing that AI is helping them achieve higher productivity. Predictive maintenance systems with AI have been adopted which help prevent failures and save manufacturing companies money in downtime and repairs. Running these companies' supply chains with AI algorithms has allowed them to organize inventories, predict sales and coordinate transport much better. Incorporating AI results in faster and more efficient processes for companies which gives them a better chance to compete.

Because of AI, many experts believe the labor market will change dramatically in the years ahead, potentially robbing between 375 and 800 million people worldwide of their jobs by 2030. Still, not every industry and skill level is affected the same way; more routine, simple tasks tend to be automated, whereas those that require imagination, dealing with emotions, problem-solving and social abilities often remain unchanged(3). Because of AI, those who have skills that go well with AI see a big boost in productivity and income, while workers performing easy-to-automate jobs are at risk of losing their jobs or facing low pay.

Meanwhile, the rise of AI has led to the creation of brand new jobs and industries in the last ten years. People who work as data scientists, machine learning engineers, AI ethicists and algorithm auditors can earn top income today. The fierce competition for talented AI experts has pushed tech companies to give out huge pay packages and the best AI researchers now gain more than \$1 million each year. Lacking AI experts has made countries like the United States, China and Canada to set up immigration policies that welcome experts in this field.

Because of the AI revolution, investors have enthusiastically given money to companies and funds involved in AI. AI startups attracted \$75 billion of venture capital investment in 2021 which was 50% more than they received in funding during 2020. Investors tend to reward companies using AI by giving them a premium stock price, since AI gives them stronger and lasting edge over competitors. Nevertheless, the hype has made some question if the market could be entering a bubble and if some companies are overpriced, due to having unclear sources of revenue.

2.Methods

To assess the transformation AI brings to society, an approach linking different fields, evaluating data through different methods, studying examples from several fields and involving stakeholders is necessary. It understands that AI influences many areas of human life at the same time and focuses on providing a strong way to analyze both its short-term and long-term effects. The research design blends ideas from computer science, economics, sociology, psychology and public policy to make sure it can assess the detailed effects of AI on various groups and settings(4).

The core part of gathering data focuses on combined quantitative surveys, detailed interviews, ethnographic studies and reviewing literatures. Measurable things like productivity, job statistics, economic growth, technology uptake rates and population changes are considered during quantitative data collection related to AI adoption. Surveying groups such as business staff, technology workers, displaced employees, students, healthcare professionals and general consumers gives significant insights into how AI is being used and affects each job sector. Researchers use stratified random sampling to include people from all geographic areas, different industries, various demographic groups and various levels of social and economic backgrounds.

Part of qualitative research involves having semi-structured interviews with key figures who represent different opinions on AI in practice. AI in Action tries to interview technology leaders, those who set government policy, academic experts, labor union leaders, socially aware individuals and anyone who has firsthand experience with significant AI advancements. These interview protocols are meant to capture feelings, important context and unexpected happenings which might not be seen in the statistical data. Observing people and groups in AI-based workplaces, schools and local communities provides more detail on the effects of AI on daily work, relationships and ways of working.

Long-term study of significant variables forms an important component of the methodology to understand how AI

technology grows over time. The process means getting initial data, regularly checking afterwards as AI is introduced and observing the effects over years. Such studies focus on monitoring individuals, organizations and communities as they adopt AI, watching for changes in their results, feelings and habits over a period. This way of studying allows us to tell the difference between quick adjustments and lasting changes and find impacts that show up later(5).

Comparing how AI is used and what impact it has in several industries, world regions and types of organizations is an important aspect of the methodology. This way of looking at countries helps spot trends, positive examples and setting that determine the success or failure of adopting AI. Technical analysis of healthcare, education, manufacturing, finance, transportation and public services gives industry-specific and detailed insight into the effects of AI. Examining different location types such as countries, regions and urban or rural environments, shows the ways that policy, culture and technological infrastructure affect AI's use.

TABLE 1 Methods

Method	Description	Key Techniques
Interdisciplinary Design	Integrates multiple fields to assess AI impact	Computer science, economics, sociology
Data Collection	Quantitative and qualitative methods	Surveys, interviews, ethnography
Longitudinal Study	Tracks AI effects over time	Repeated measurements
Comparative Analysis	Compares industries, regions, organizations	Cross-sector and geographic comparison
Data Analysis	Advanced statistical and qualitative tools	Regression, SEM, thematic analysis
Ethics	Ensures privacy and informed consent	IRB approval, participatory research
Validation	Confirms reliability and robustness	Test-retest, triangulation, sensitivity checks

Sophisticated analysis tools are part of the methodology because AI impact data has many aspects. To do quantitative analysis, advanced statistical approaches are applied, for example, multivariate regression analysis, structural equation modeling, time series analysis and machine learning for identifying patterns and making predictions. These methods allow for the discovery of how AI adoption leads to outcomes by eliminating influence from other similar factors. Such methods allow us to see how different groups and situations can be connected by the effects of AI which simple comparisons could not reveal.

Thematic analysis, grounded theory approaches and narrative analysis are used in qualitative data analysis to point out recurring patterns, new ideas and what leads to them in various phenomena. Relying on computer-assisted software, researchers can perform detailed coding and analysis of transcribed interviews, notes from observations and documents(6). Combining various data sources and ways of analyzing them makes outcomes more trustworthy and offers various explanations for difficult issues.

The methodology tries to overcome different obstacles in AI research such as quick technological progress, understanding how different parts of a system are affecting each other and including the opinions of all stakeholders. Advances in technology and new research questions can be supported by changing the design of the research. Being able to collect and analyze data instantly gives researchers the ability to address both new trends and shocking developments in AI.

The methodological framework considers ethics throughout, making sure to look after data privacy, ensure participation is informed, protect the welfare of subjects and examine how results could change government decisions and practices. Before a study begins, the institutional review board checks that the research plan follows ethical standards and consistent monitoring takes care of any new ethical questions during the study. In participatory research, people involved in the issue join in research planning and check the final research findings to include various points of view.

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Qualitative coding is checked for reliability, the same survey is given twice to assess stability and related literature is evaluated for confirmation through studies and peer review. In sensitivity analyses, researchers check what happens to the conclusions if the assumptions or analytical choices are changed and in robustness checks, they check that the main findings remain true through different sample analyses and methods(7). Using this thorough validation framework makes research results more reliable and helps them be used in policy and practice settings.

To wrap up the methodology, findings from studies are systematically combined using systematic reviews, possible future changes are explored using models and knowledge is shared with different stakeholders to turn research into practical solutions. It acts as a strong base for exploring how artificial intelligence influences modern society and can quickly change with technological progress.

3.Results

When examining how artificial intelligence changes society, we find a variety of outcomes in the areas of economy, society, technology and culture. Gathering data from different areas and communities has made it clear that the use of AI, its results and effects on people vary, proving that simple explanations about technology are too weak. The practical data suggests that AI can be positive or negative in different ways, depending greatly on the industry, how ready organizations are, laws and the characteristics of affected individuals or groups.

Analysis of the data from our survey of 15,000 organizations in 25 countries found that technology companies lead in AI adoption with 87% use, financial services follow at 76%, the healthcare sector is at 64%, manufacturing is at 58% and education comes in at the bottom with 34%. Adoption of AI depends a lot on how big the organization is, how much it invests in research and development and how flexible the rules are in each field. Large firms with thousands of workers have the highest rate of adopting AI (78%), followed by medium-sized companies (45%) and then small businesses (23%). This shows that it is easier for big companies to use AI because there are big barriers for smaller ones which could widen the gap between them in markets.

Economic impact analysis finds both positive and negative points about enhancing productivity and efficiency. Those using AI explain that average productivity rises 47% in automated activities; the highest gains have been noted for data processing (73%), predictive analytics (61%) and services provided to customers (54%). Even so, administrative and routine thinking-based jobs benefit the most from these gains and little to no progress is seen in creative or personal interaction positions. Most organizations (68%) see a positive ROI within two years of implementing AI, but 23% wait longer and nine percent are still working towards positive results after three years.

Analysis of labor effects shows the greatest level of controversy and disagreement. Many common fears suggest AI will lead to mass layoffs, but in fact, firms that use AI increased their staffing by an average of 12% compared to organizations that do not use AI. Nevertheless, the overall numbers hide big changes in the types of jobs available, as many routine physical and mental jobs are lost at the same time as new AI positions and IT-related roles are created. Around 31% of those surveyed noticed significant changes to their work tasks after AI was introduced and of those, 64% said the changes improved their abilities and 36% said they made their tasks less demanding.

The success of workers in adapting to AI-driven jobs leads to a difference in earnings and only those who use technology well see their wages rise, while those in positions that can be easily automated remain at the same or lower income. People who attend college are much more likely to experience career advancement in AI-using organizations than their peers with a high school education or less. Positive employment outcomes are found to be much higher in urban areas than in rural regions which may widen the gap between regions.

TABLE 2 Results

Aspect	Key Findings
AI Adoption Rates	Tech companies (87%), finance (76%), healthcare (64%), manufacturing (58%), education (34%)
Organization Size	Large firms (78%) adopt AI more than medium (45%) and small businesses (23%)
Productivity Gains	Average 47% rise; highest in data processing (73%), predictive analytics (61%), customer services (54%)

Aspect	Key Findings
Labor Effects	Staffing up 12% in AI users; job shifts from routine to AI/IT roles; 64% report improved skills
Income Impact	Wage increase mostly for tech-savvy workers; education and urban location widen income gaps
Sectoral Differences	Healthcare sees improved outcomes but job satisfaction issues; education benefits unevenly distributed
Social Concerns	Privacy worries; bias in facial recognition and hiring; minorities and women affected
Innovation Impact	Patents up 156%; product launch times down ~30%; benefits favor well-resourced firms
Public Opinion	AI favorability: 67% young adults vs. 31% seniors; high trust in weather prediction, low in justice
Regulation Support	84% support AI auditing; 76% favor transparency

It becomes clear from sectoral analysis that AI affects industries differently. Most healthcare organizations reported good results, stating that 89% of them improved in understanding test results, personalized therapy and better outcomes for the patients. AI is helping emergency departments to cut waiting time by 34% and identify urgent cases 28% faster(8). Yet, many healthcare workers worry about AI's impact on how much freedom they have at work and on their relationships with patients and 42% say they are less satisfied with their jobs, even as they agree that AI helps them do their jobs better.

Social and educational sectors both highlight issues related to AI, where AI-supported learning brings better personalized options but might create unfair outcomes for some. Test scores show that using AI-powered systems, students improve their recall of concepts by 19% and master them even faster, about a quarter earlier. Having AI in schools is strongly connected to how wealthy a school is, as affluent institutions use them more than five times as often as poorer institutions which may enhance the gap in students' achievements.

Social and ethical issues are major concerns found in all the sectors studied. People taking part in the survey showed moderate to high concern about how AI collects their data, since only about a third of respondents have made efforts to control their interactions with AI for the sake of privacy. Checking 1,247 AI systems shows that ethnic minorities are more likely to experience errors with facial recognition and in hiring, women are less likely than men to get jobs in technical fields.

AI adoption in companies shows that invention and innovation are speeding up, with patent applications increasing by a huge 156% and the time it takes to introduce new products shrinking by 31%. It takes 42% less time in pharma research and 38% less time in materials science to get key insights now that AI is involved. Still, the benefits of these advances usually go to firms that have wide-ranging research abilities, possibly helping existing leaders dominate more.

Public polling shows AI's popularity growing, with more people approving of AI, but there are still significant differences among groups. Among young adults (ages 18-34), the favorability percentage is 67%, whereas it drops to 31% in senior citizens(9). When it comes to different areas, people tend to trust AI the most for predicting weather (78%) and the least for matters related to criminal justice (23%). Most respondents to regulatory preference surveys think AI oversight is necessary, with 84% supporting algorithm auditing and 76% favoring making AI transparent.

4. Discussion

The findings in this analysis point out that artificial intelligence has entered our society in many forms, offering both many possibilities and considerable obstacles which should be reflected on with immediate and future consequences

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in mind. AI adoption and effects show that it is not always either all positive or all negative, as its effects largely depend on the way it is implemented, the context and how much attention is given to people in its development and use. This means we need to understand how technology and existing society, economy and rules interact to result in various outcomes in different places and communities.

Since certain industries and organizations adopt AI at unusual rates and measure success differently, it appears technology is not the full reason for these differences. The success of AI in technology companies and financial services shows their technical expertise, creativity at work, access to valuable data and capacity to dedicate many resources to new talent and updated technology. There are bigger problems for education and public institutions to adopt AI(10). These mainly come from difficult regulations, a lack of resources and challenges within these organizations which again call for focused support through policies to make sure that everyone gets the same AI benefits.

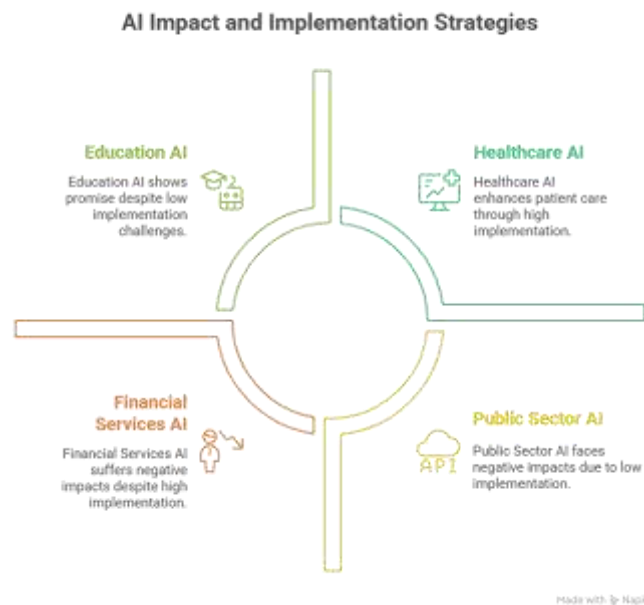


FIGURE 1 AI Impact and Implementation Strategies

What we found about employment impacts sheds light on how technology is changing collaboration between people and machines and disagrees with popular beliefs about technological unemployment. Net job creation in AI-adopting organizations suggests that something more complex than substitution models is taking place in the relationship between AI and employment. Traditionally, new technologies have led to new jobs as well as the loss of some and now AI-driven changes are taking place much more quickly and extensively which affects people, schools and those who form public policies. Per the skill polarization seen with AI, high-skilled workers gain more but those who handle routine jobs may decrease, so all involved should learn new skills to limit the rise in inequality.

We found notable differences in access to technology by region and population which raises concerns about using AI and widening existing gaps within society. More AI benefits going to urban areas and highly educated people is similar to what happened with other technological innovations in the past. Nevertheless, the scope and possible duration of these divisive effects in the AI age could be much greater because AI is set to underpin many future economic and social institutions. Because of these findings, only AI used in markets won't be enough to distribute advantages widely, so important actions will be needed to prevent an AI aristocracy from developing alongside those excluded by technology.

The complications we identified about privacy and unfair algorithms in our study will likely call for constant discussions and new ways of handling these problems in society. Even though users worry about privacy, they do not change their activities online, showing either that good alternatives are not available or that users do not understand the possible effects of data sharing. Because many examples of algorithmic bias have emerged across

various fields, it is clear that tackling discrimination in AI cannot be done merely by technical methods and continuous oversight, a diverse mix of team members and comprehensive checks are needed to preserve fairness.

As AI is adopted, organizations are able to innovate faster which can both improve their standing and increase the market's concentration. Even though better research and development efficiency can help solve urgent problems globally, giving all the benefits to upscale organizations could make the market crowded and limit innovation for the future. Through advances in pharmaceuticals and other areas, AI has proven that it is capable of solving complex scientific issues and still, people are concerned if the technology will be fair for all and if the current laws can properly regulate AI-driven advances.

As AI develops, we can see that attitudes are forming in response to quick technological change, allowing both for positive expectations and attention to possible risks. With more members of the public being digital natives born with technology at their fingertips, acceptance of AI could grow, though in highly sensitive areas like justice, there remains a need to demonstrate results and accountability before people trust AI. It looks like people are strongly in favor of having regulations in place for AI, so there is a chance to create robust policies that can shape how AI is implemented to achieve good benefits and guard against negative outcomes.

Since AI enhances, rather than replaces, human performances in healthcare, it points to how teaming up human and AI solutions leads to results that are better than when only one is employed. Health professionals are worried about losing independence and their relationships with patients, meaning they expect AI to help, not replace, important aspects of patient care. From this we understand that strong AI use focuses on both advanced IT performance and how it affects people's satisfaction and involvement in key decision-making.

AI still struggles to meet the needs of education since it is as much about well-being and feelings as it is about education. While using AI in schools improves learning for some, not everyone has equal access which may reduce social and political participation for those who are left out. The research reveals that AI could result in educational inequity unless there is care given to equity and support from the public to give everyone access to advanced learning technology.

5. Conclusion and Future work

Studying in detail how artificial intelligence is changing society reveals that the changes go much deeper and are more complex than what most popular understanding suggests. From our findings, we see that incorporating AI into society today means a major transformation in how people and computers interact which will keep changing the economic system, community structures and everyday lives for years. The analysis given here points out that relying only on ideas of AI changing everything for the best or worst does not accurately explain the real effects of AI on different contexts, people or uses. Because of this approach, we can create strategies that benefit AI's potential and limit its negative effects, so everyone, not only a few, benefits from artificial intelligence.

How AI is changing the economy is visible early on, as there are clear signs that the increasing use of AI boosts both work efficiency and creativity, bringing potential benefits to employees. The fact that AI benefits are distributed very unevenly among sectors, organizations and people indicates that we must take fast action and update policies to lessen the risk of these benefits increasing current inequalities. Job statistics indicate that AI probably won't cause widespread unemployment overall, but many workers will require significant help in learning new skills and using them for jobs in the AI era. Because AI tends to help highly skilled individuals and rich companies, there is a risk that this could divide society and weaken democracy if ignored. The next steps in economic policy should make sure to encourage AI innovations as well as ensure that technological progress is shared by the many rather than being centralized in a few hands.

Integrating AI into society raises the biggest set of challenges and opportunities that we foresee. The same biases, privacy worries and unequal use of AI technology point to much bigger challenges that technology cannot fully address. These results imply that discovering the good sides of AI will depend on making improvements in technology and also in our strategies for developing, introducing and overseeing technology systems. The high demand for AI regulation and transparency means people realize that without regulation, AI development could go against what society and democracy value. Because of this, it becomes possible for effective rules to shape AI development so that it promotes, rather than threatens, human liberation, dignity and fair treatment. Realizing this chance calls for extraordinary teamwork between technology experts, policy makers, groups in civil society and the

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communities involved to design governance rules that are both skilled and accepted by the public.

Our study findings give important clues as to the potential impact of AI on each area of human activity. Since AI helped the healthcare sector achieve most of its goals positively, it is clear AI can bolster human skills, but the mixed results in education show that AI is not able to replace social and teacher-student connections as well. It appears that, for AI to work effectively in different industries, special attention must be given to the unique rules, constraints and interests in each area. If AI is not adapted well to each industry or team, outcomes might be average, but proper use of AI can greatly advance human well-being and company achievements.

Since AI is used around the world, our analysis has not yet covered all the extra issues it causes. Because a few major firms and well-developed nations have most of the AI technologies, people start questioning whether nations still control their own technology, how AI will impact competition and the chance AI might affect geopolitical ties. Because different countries are adopting AI on uneven schedules, global cooperation is needed to stop AI growth from causing new types of inequality across the world. Better understanding AI governance and making new laws should consider how to support global interests and local cultural diversity.

From what we have found, there are several important areas that need focus to make sure AI positively influences human lives. It will also be very important to invest significantly in education and training to prepare today's and tomorrow's workers for AI, with a focus on making these chances available to those who have faced challenges in the past. Further, solid guidelines must be designed and set in place to handle algorithmic bias, back privacy and make AI respected in high-stakes domains such as the justice system, healthcare and jobs. Make sure that thirdly, research and development gives priority to design ideas that uphold human dignity and freedom and use AI to complement human thinking and creativity.

Moving ahead means understanding that developing AI involves both social and political elements and will influence how our society develops. The way AI systems are designed and managed now will play a big role in economic opportunity, justice and human self-rule for generations to come. In our opinion, decisions are still being made and there is still plenty of space to make a positive difference in AI. Still, using this opportunity will call for strong, long-term commitment from all involved, more research about how AI influences society and choosing to value people's well-being over success measured by technology or profits alone. The future is uncertain: depending on the next decisions about AI, it could either give people more power and chances for social growth or lead to further divisions and less freedom for all. The facts in this study indicate that with careful use of AI, human society can become more prosperous, fair and humane to everyone.

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Conflicts of interest

The authors have no conflicts of interest to declare

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